Selective Laser Melting
(SLM)

3-D printing has opened a new world of manufacturing possibilities. Cost-effective engineering of customized hardware components for the aerospace industry is no longer a dream of the future, it is here; and ASRC Federal brings this capability to our government customers and industry partners at our Advanced Engineering and Manufacturing Center (AEMC) in Huntsville, Ala.

Selective laser melting (SLM) is a metallic powder-based additive manufacturing technique that produces an exact reproduction of a 3-D CAD model through an additive layer-by-layer approach. This technology allows for the creation of incredibly advanced geometries that are simply not possible to fabricate using traditional manufacturing techniques such as milling, drilling, casting or forging.

Unlike 3-D printers that simply print colored plastic models, SLM prints fully functional components from a variety of metal alloys, including several stainless steels, aluminum alloys, titanium alloys and even nickel-based superalloys. We have experience processing 316L stainless, GRCop-84, Inconel 718, Inconel 625, Haynes 282, Monel K-500, W-24Re, and Ti-64.

Our Facility:

Located in Huntsville, Ala., our AEMC facility consists of:

- 2,400 square feet of manufacturing space
- 2,800 square feet of office space
- 480 square feet of raw material and finished product storage
- 450-square-foot material properties evaluation laboratory
- 1,200-square-foot conference/training room

The equipment available includes:

- Two Concept Laser M2 Laser Cusing machines
- Gromax Enterprise W-V500 Wire EDM
- Precision Surfaces International ML32-MA metallurgical mounting press
- AmScope ME1400TC-10MT metallurgical microscope
- Precision Surfaces International P20FS-1-R5 metallurgical grinder/polisher
- MLab Laser Cusing machine
- Lucifer Furnaces 55AM-121212 heat treatment furnace
- Starret 3814 hardness tester
- Tinius Olsen H50KS tensile test machine
- GOM ATOS Core structured light scanner post-build inspection machine

Benefits:

SLM costs are considerably less than traditional manufacturing because it significantly reduces production lead time (by as much as a factor of 10). It is ideal for prototyping and low-volume production and "prints" metal components layer-by-layer. Overall, SLM manufacturing enables highly efficient structural design and massive weight savings, perfect for flight.

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Sample Projects

Additively Manufactured Oxidizer Rich Preburner

U.S. AIR FORCE

Our team was contracted by the U.S. Air Force to design and demonstrate an additively manufactured oxidizer rich preburner (ORPB) due to a congressional mandate for the Air Force to develop an oxidizer rich staged combustion (ORSC) cycle engine to replace the Russion RD-180 engine that was used to power the Atlas V launch vehicle into orbit.

Current ORPB designs offer good performance, but substantial thermal gradients remain in the flow, which can lead to transient "hot spots" that can damage or even destroy the turbine. Using SLM to manufacture the ORPB will increase its performance by reducing the thermal gradients to +/-2.5°F of nominal), while adding almost nothing to its cost. We will also develop the SLM process for Monel K-500, a nickel superalloy well-known to be burn resistant in high pressure, oxygen rich conditions.

Advanced Regeneratively Cooled Combustion Chamber

NASA

Our team is currently executing a NASA Phase II SBIR contract in which we are continuing the development of an advanced regeneratively cooled combustion chamber. The regenerative cooling scheme is a radical departure from the traditional approach and provides an order of magnitude improvement in cooling capability. The success of our technology is entirely dependent upon using SLM for manufacturing, as traditional SM would be unaffordable to use.

The final deliverable for the contract will be a water-cooled spool piece that will undergo hot fire testing in the NASA Marshall Space Flight Center (MSFC) Test Stand 115.

High Area Ratio Aerospike Nozzle for SDACS

The team successfully hot-fire tested the world's first additively-manufactured proportional thruster, two times within four hours, at Orbital ATK's facilities in Elkton, Maryland. Under contract with the Missile Defense Agency, the SLM team spent two years and approximately $1 million designing, analyzing and manufacturing a next-generation, high-performance, run-hot thruster that can be used in future solid divert and attitude control systems (SDCAS) that are one of the most critical components of our Nation's hit-to-kill missile defense shield (e.g. THAAD, EKV, SM-3, and Patriot).

One-Piece Toroidal Vessel

Orbital ATK

We recently completed an Orbital ATK-funded IRAD project that demonstrated the manufacturing of a high pressure toroidal pressure vessel using SLM. The pressure vessel was fabricated entirely without internal supports, thought to be impossible given the over 1-inch radius of the internal pressurized volume.